THE GENUS OROTHRIPS MOULTON

(Thysanoptera: Orothripini)

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This paper is another in a series on the Aelothripoidea in which we are reviewing, illustrating, and making available all known information on various groups of thrips. Over a period of about forty years the majority of workers in this group of insects have concerned themselves chiefly with describing new species. In North America, particularly, enough is known of this order of insects now to begin bringing together and evaluating our knowledge of certain groups.

Since Moulton's original description of the genus *Orothrips* in 1907, based on *kelloggii*, this worker has described four additional species. It is interesting to note that, like *Erythrothrips*, this genus is also represented in India. In Australia[1], Europe and Africa these genera appear to be replaced by *Desmothrips* Hood, *Melanthrips* Hal., *Allelothrips* Bagn., and *Audiothrips* Moulton. It has been possible, through the kindness of Mr. Moulton, to study all the types of *Orothrips* which are in the Moulton collection and, in addition, the writer has collected and studied many hundred specimens of this genus from the western United States.

On the basis of the presently known species, the genus *Orothrips* is readily divided into two distinct groups, as was originally done by Moulton (1927), on the basis of the shape of the sensory areas on antennal segments III and IV. The value of this character, however, should not be over emphasized. Hood (1936) in his discussion of the new genus *Euceratothrips* was led "to the inescapable conclusion that sensoria are a minor, rather than a major, character in the definition of higher groups, and confirm the writer's repeated contention that such characters, though at once striking and distinctive, are of no great taxonomic moment."

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[1]*Orothrips australis* Bagn., 1914 = *Desmothrips*. Hood, 1915.
Orothrips propinquus Bagn., 1916 = *Desmothrips*. Bagnall, 1928.
Orothrips tenuicornis Bagn., 1916 = *Desmothrips*. ibid.
Orothrips unguttipennis Girault, 1926 = *Desmothrips bagnalli* Karny, 1920. Kelly and Mayne, 1934.

Further, as one studies the aeolothripids and attempts to weigh the better characters in evaluating valid, higher groups, genera and species, the studied opinion of Priesner (1936) can well be considered. This last-mentioned writer states that in studying *Aeolothrips* and employing the sensory areas on the antenna as a specific character "Caution is advocated since one encounters not uncommonly monstrous specimens, and the study of a series of examples is considered necessary to obtain a decision on the specific constancy of the organ in question."

The same author wrote (1936) "In *Melanthrips,* I have found the sensory organs of the 3rd and 4th antenal joint, in spite of certain variations, very reliable for the purpose of separating difficult species." Another character which Priesner found helpful in studying *Melanthrips,* as did the present writer in the case of *Dactuliothrips* and *Ankothrips* (papers previously published in this journal), is the chaetotaxy of the pronotum. So far, it has been unnecessary to use this character in separating *Orothrips* species.

The diversity of the type of sensory areas has been pointed out and illustrated by Priesner for *Melanthrips* in which there are nineteen species. It is possible, therefore, as more species of *Orothrips* become known, (although the genus appears to be a very small one) that the above-mentioned natural grouping may break down. Among various aberrant specimens, the writer has two specimens of *kelloggii* in which the two sensory areas are connected at the tip in the same manner as *Melanthrips nigricornis* Bagn. (see Priesner, 1936, Plate II, fig. 17). Also, we have one male specimen of *yosemitii* in which the sensory areas on segment IV are fused.

Further, on studying a long series of specimens, other variations or oddities are noted. An individual is seen now and then with the number of palpal segments reduced from seven to six, or with the number differing on each palpus of an individual specimen. We have pointed out already the variation in this character in our study of *Erythrothrips* (Bailey, 1947). We have one specimen of *O. yosemitii* with six cross veins on the right fore wing. In general, *Orothrips* collected in the northern portion of their range and at high elevations are darker in color than those taken in central and southern California at low elevation.

The undesirability of establishing families, and even higher categories, then becomes obvious when a few genera only are known which in turn are composed of only a few species, which are based sometimes on single specimens.

In the light of the above discussion, a redescription of the genus *Orothrips* is in order.

OROTHRIPS Moulton, 1907

Antennae nine-segmented, all segments freely articulated. Segments three and four each with two similar sensory areas. Ocelli present with interocellar bristles. Maxillary palpi geniculate and seven-segmented. Labial palpi four-segmented, plus a minute basal attachment. Prothorax wider than long and with a row of strong spines on posterior margin. Fore femora thickened in both sexes. All tibiae armed, the tip of the fore tibiae with two well-developed spines. Second segment of fore tarsus with finger-like hook. Wings present in both sexes, large, bluntly rounded at tip and gradually tapering to base, cross veins present. Fore wings with two broad, dark bands, one near center and one at tip. Scale and extreme basal portion somewhat darker colored than cross bands. Ovipositor upturned. Posterior three abdominal segments taper abruptly, dorsum of last segment not split. Male much smaller than female. Sensory areas on fourth antennal segment very large. Abdomen slender with first segment much longer than second. Genitalia without claspers.

Genotype: *Orothrips kelloggii* Moulton, 1907, by monotypy.

Within the two groups of this genus, species differentiation is difficult since *keeni*, *raoi*, and *variabilis* were described on minor differences in color and size. The species *keeni* was described as having sensory areas on antennal segment III one-quarter the length of the segment (or 21 microns) and those of segment IV two-fifths its length (or 31 microns). In a long series of *kelloggii*, which includes specimens from Canada, Oregon, Nevada, Arizona, and California, we find the variation in the length of antennal segment III to range from 91 to 130 microns and that of IV from 84 to 123 microns in length. The two sensory areas on each of these two segments are not the same length on each or both segments. Dependent upon the angle of the antenna in the balsam, the depth and density of the balsam, and the degree to which the transmitted light is focused, a variation in the length (and width) of these sensory areas is observed. In the specimens of *kelloggii* studied we have measured the shorter sense area in each case and record the variation of this structure on segments III and IV

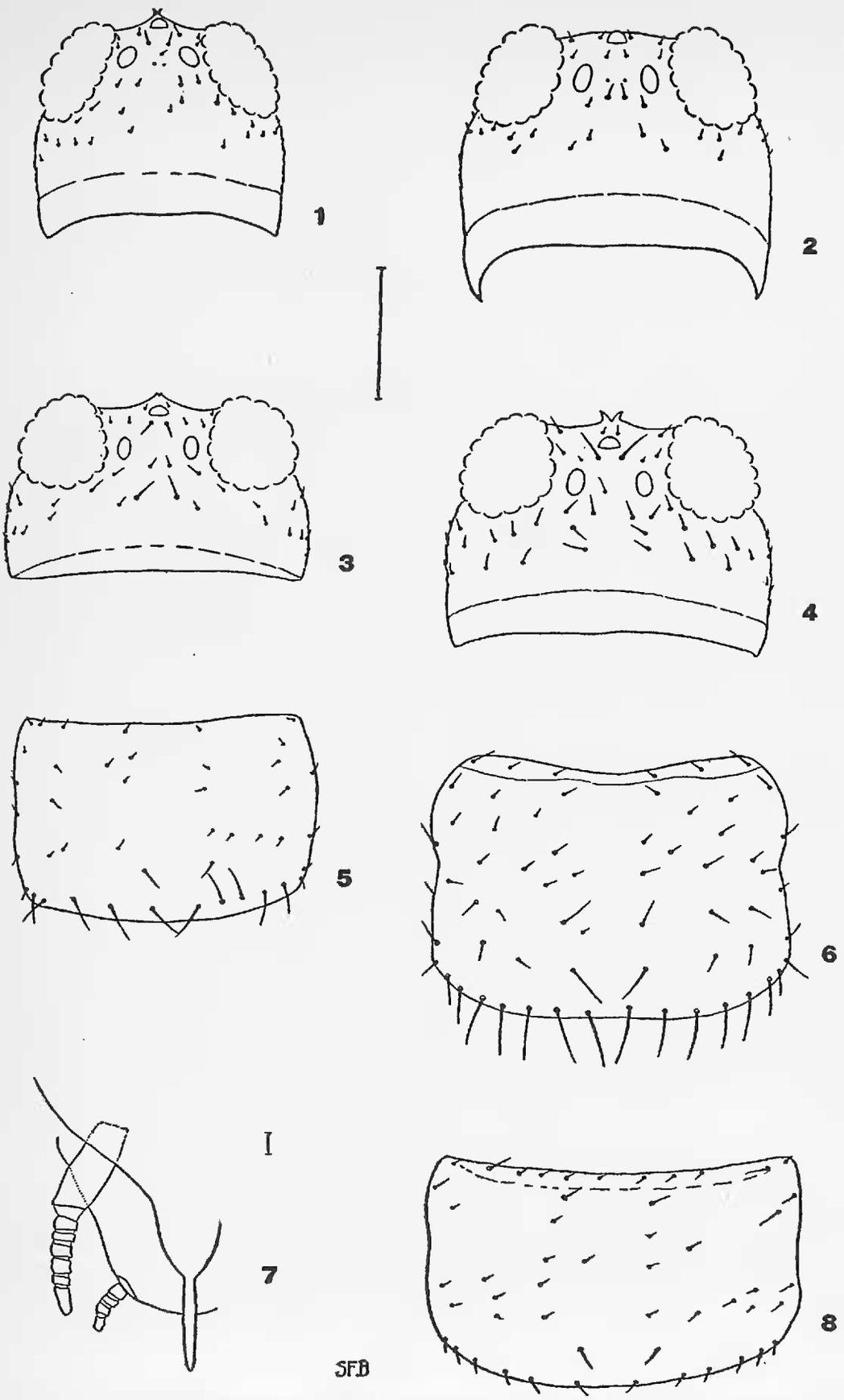

PLATE I

Orothrips. Dorsum of head of: 1, *yosemitii;* 2, *raoi;* 3, *keeni;* 4, *kelloggii.* Pronotum of: 5, *keeni;* 6, *kelloggii;* 8, *yosemitii.* Figure 7, maxillary and labial palpi of *yosemitii.* Scale: Figure 7, line equals 0.01 mm. Figures 1-6, 8, line equals 0.1 mm.

to be from 33 to 49 microns. In general, specimens of aeolothripids nearly always exhibit considerable reddish pigment as well as varying degrees of contrast in grey, black and white on the wings. Further, it should be noted that some years and some individual collections, are more robust, or small, in relation to what might be established as "average." On this basis one might set up varieties of forms which in such a distinctive, small genus is undesirable. The smaller antenna and the differences in the chaetotaxy of the head and pronotum (see figures 3 and 5), when compared with *kelloggii*, appear to set *keeni* apart as a distinct species. However, a series of specimens should be studied to confirm this conclusion and to present more complete knowledge of the extreme variations within the species. We recently collected on *Prunus* at Klamath Falls, Oregon, the type locality of *keeni*, but took only *yosemitii*.

Over a period of years, the writer has collected large numbers of specimens of *Orothrips* in Vacaville and vicinity, the type locality of *variabilis*, but has never been positive of the identity of this species. The species *yosemitii* exhibits the following variations in length in antennal segments: III, 71 to 97 microns; IV, 65 to 84 microns. It will be noted that the measurements given for these segments in *variabilis* by Moulton fall within the extremes. Also, there is as much as fifty per cent variation in the diameter of the oval sensory areas on segment III of *yosemitii*.

The only other known species with oval sensory areas, *raoi* from India, likewise is almost identical with *yosemitii*. A study of a series of exotic specimens in the future may bring forward sufficiently distinctive characters to make more accurate separation possible. At present we are able to give only a provisional key to the described species. While the key to the species given below is based largely on the sensory areas and length of antennal segments III and IV, there seems to be no other way to separate these species at present. In the illustrations accompanying this paper, the similarity of the head of *raoi* and *yosemitii* will be

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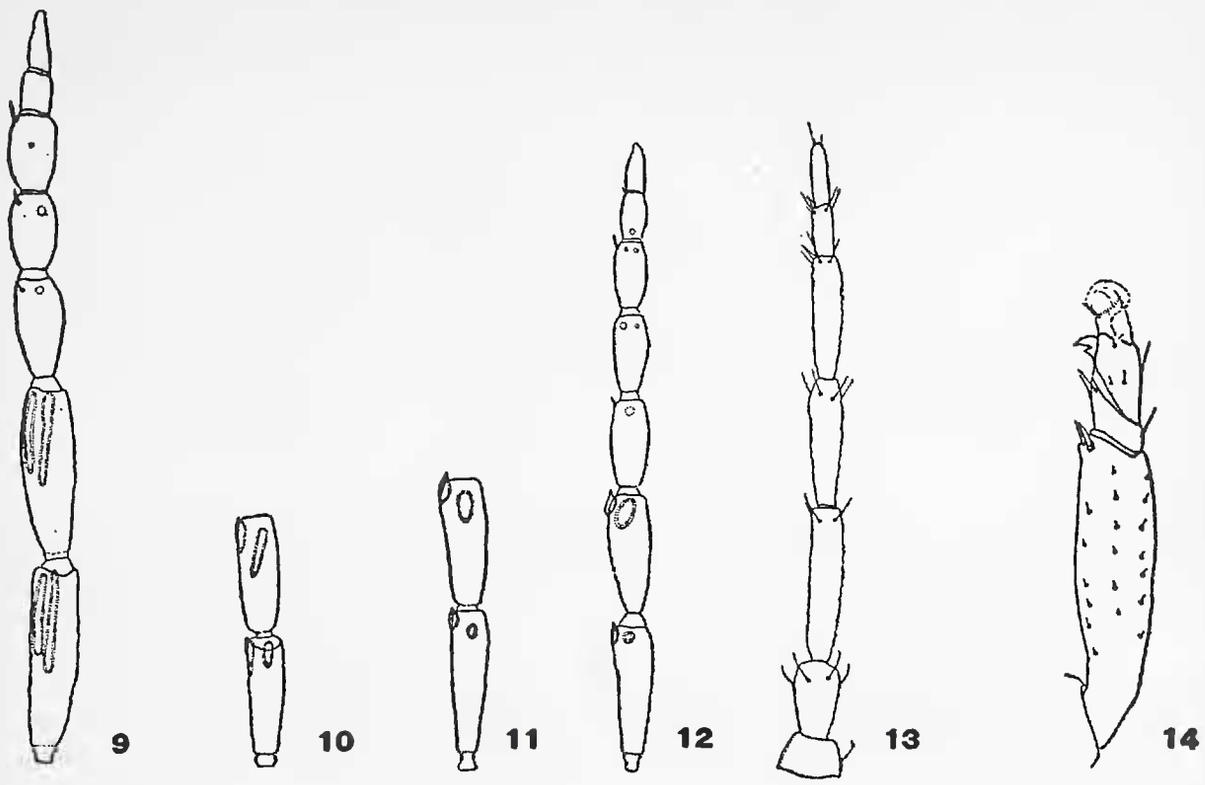
PLATE II

Orothrips. Antenna of: 9, *kelloggii* (segments 3-9); 10, *keeni* (segments 3 and 4); 11, *raoi* (segments 3 and 4); 12, *yosemitii* (segments 3-9); 13, mature larva of *yosemitii*. Figure 14, front tarsus of *yosemitii*. Terminal (dorsal) abdominal segments of: 15, *kelloggii*, male; 16, *yosemitii*, female; 17, *kelloggii*, mature larva. Scale: Figure 9-17, line equals 0.1 mm.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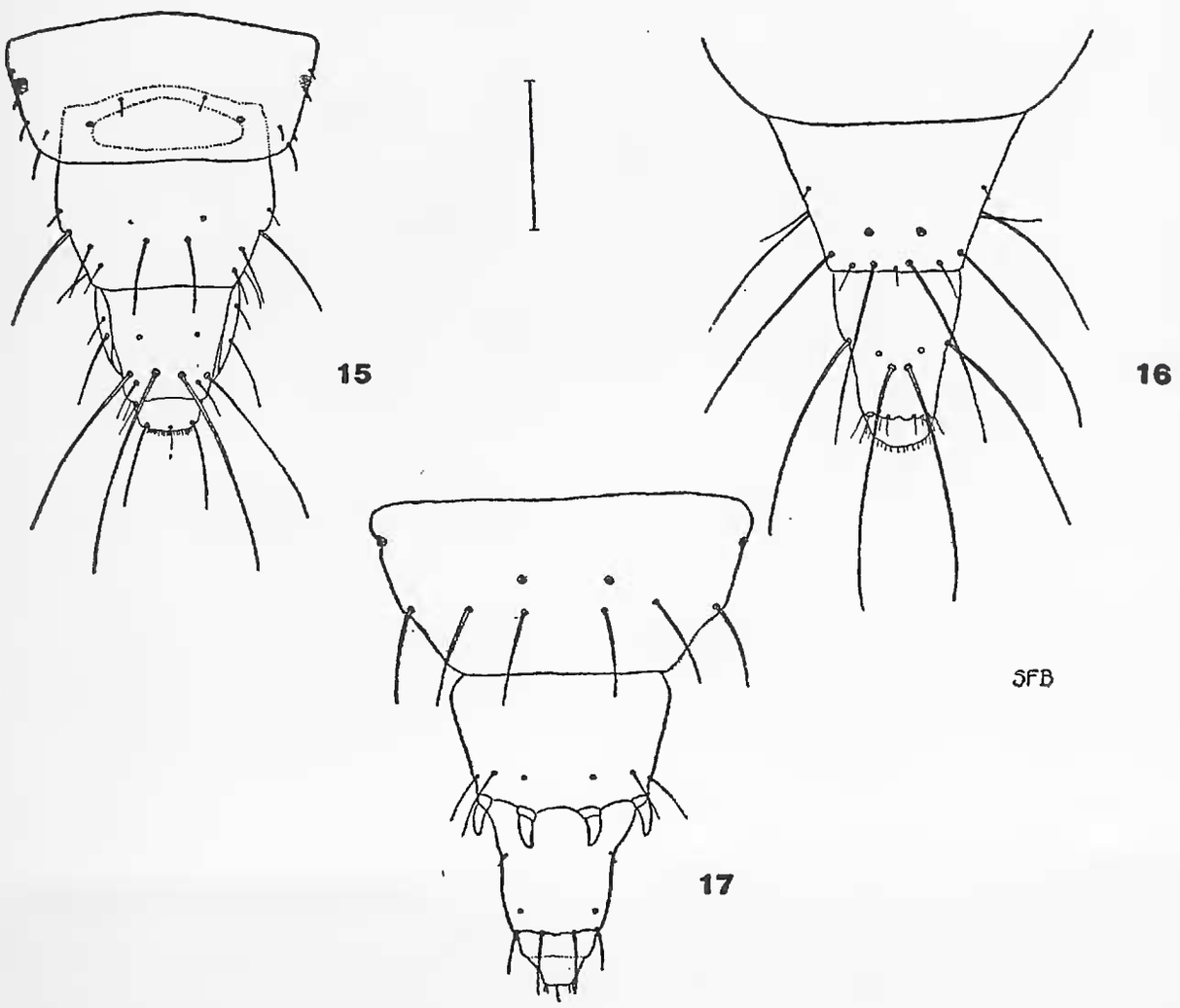
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noted. There is even a greater similarity in the pronotum of these two species. The type slide of *variabilis* has two specimens mounted thereon, one laterally and one dorsally. We consider *variabilis* to be a synonym of *yosemitii* as it falls into the extreme range of color and size when a long series is studied. There are insufficient outstanding characters on the terminal abdominal segments to enable one to construct a key to the males. Furthermore, the males of *keeni* and *raoi* are unknown.

Provisional Key to the Species of Orothrips

1. Sensory areas on antennal segments III and IV elongated and definitely linear, two to each segment 2
– Sensory areas on antennal segments III and IV round or oval, two to each segment 3
2. Sensory areas on antennal segment III about one-fourth length of segment which is about 84 microns in length. Antennal segment II brown in color similar to body, segment III light brown in basal third. Total body length about 1.6 mm..... .....*O. keeni* Moulton, 1927 (W. No. America)
– Sensory areas (about 50 microns in length) on antennal segment III extending nearly to center of segment which is 91 to 130 microns in length. Antennal segment II brown or with tip light brown, segment III yellowish brown in basal half. Remainder of segments brown. Total body length about 2.4 mm..... .....*O. kelloggii* Moulton, 1907. (W. No. America)
3. Sensory areas on antennal segment III almost equal in size, irregularly oval and the smaller one from 9 to 13 microns long by 6 to 11 microns wide. Antennal segment II dark brown at base shading to yellowish brown at tip, segment III yellow to yellowish brown in basal half. Remainder of segments brown. Antennal segment III, 71 to 97 microns in length. Total body length about 1.6 mm .....*O. yosemitii*[2] Moulton, 1911 .....and *O. variabilis* Moulton, 1927 (W. No. America)
– Sensory areas on antennal segments III and IV oval, and nearly all equal in size. Length of antennal segment III, 105 microns. Total body length 1.58 mm.....*O. raoi* Moulton, 1927 (India)

Catalog of the Species of Orothrips Moulton, 1907

1. KEENI Moulton, 1927. North America. Oregon: Klamath Falls. *Prunus emarginata.* May. Known from original collection only. Slide No. 902. Holotype.

2. KELLOGGII Moulton, 1907. Genotype. North America. British

[2]The original spelling of this name by Moulton has been retained rather than that used by the same writer in 1927 (i.e. *yosemitei*).

Columbia, Oregon, Arizona, California: Widely distributed. Manzanita and madrone blossoms, Arbutus, plum and *Prunus demissa.* January to June. Slide No. 179 ("holotype"), 2 females.

New records: Talent, Oregon, plum, March 5, 1941. L. G. Gentner. Prescott, Arizona, manzanita, March 2, 1925. W. W. Jones. Bayles, California, manzanita, March 16, 1939. A. T. McClay. Huntington Lake, California, manzanita, June 27, 1948. A. T. McClay. Malahat, Vancouver Island, B. C., madrone, June 17, 1948. S. F. Bailey.

3. RAOI Moulton, 1927. India, Bangalore. Host plant unknown. Known only from original collection. Holotype slide No. 1226.

4. YOSEMITII Moulton, 1911. North America. British Columbia, Wyoming, Oregon, Washington, California: Widely distributed in foothills to 8100 feet elevation. *Amelanchier,* grass and flowers of live oak, *Ceanothus,* Manzanita and plum. March to July. (One collection only of "variabilis" is known, i.e. Vacaville, California, from Cherry blossoms in May). Slide No. 101 ("holotype"), 2 females. "Holotype" slide of *variabilis,* with no number, is of two females also.

New records: Pospect, Oregon, sweeping, June, 1938. A. T. McClay. Klamath Falls, Oregon, *Prunus demissa,* June 10, 1948. S. F. Bailey. Mt. Rainer Nat'l. Park (East side), Wn., flowering shrub, June 19, 1948. S. F. Bailey. Satus Pass, Wn., *Ceanothus;* June 19, 1948. S. F. Bailey. Russellman Park, Mt. Diablo, California, sweeping grass, April 8, 1936. S. F. Bailey. Emerald Bay, Lake Tahoe, California, *Ceanothus,* July 7, 1939. S. F. Bailey. Kit Carson Pass, California, sweeping wild flowers, July 1, 1936. S. F. Bailey. Cajon Pass, California, *Ceanothus,* April 12, 1936. R. M. Bohart. Jenny Lake, Wyoming, *Ceanothus,* June 21, 1940. G. F. Knowlton.

Like most of the aeolothripoid members of this group of insects, *Orothrips* species reach their greatest seasonal abundance in the spring. The first species to appear is *kelloggii* which may be found as early as December in the blossoms of manzanita and madrone, chiefly at low elevations. As these hosts continue to bloom, northward and upward, we have found this thrips as late as May and as high as 7000 feet. The adults oviposit in the flowers and the larvae feed therein (Moulton, 1927). When fullgrown, the yellow larvae (with distinct pink bands around the abdominal segments) drop to the soil beneath the hosts. After finding a suitable crevice several inches below the surface, they spin a cocoon

(Bailey, 1940) and there pass the remainder of the year. The other common species, *yosemitii,* has a similar seasonal cycle and habits. It is found chiefly in *Ceanothus* flowers and appears from March at lower elevations to July in the high mountains. Its distribution appears to be limited by that of *Ceanothus* species on which it has been collected up to 8100 feet elevation. Both of the above discussed species are very common and undoubtedly occur throughout the far western states. These thrips have only one generation a year.

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